



**National Aeronautics and
Space Administration**

**Office of Safety and Mission Assurance (OSMA)
Software Assurance Research Program (SARP)**

**Level I Technical Program Plan
(FY05 - FY07)**

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OSMA Software Assurance Research Program Level I Technical Program Plan

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Table of Contents

1.0	INTRODUCTION	1
1.1	Purpose.....	1
1.2	Program Background	1
1.3	Program Goal.....	1
1.4	Program Objectives.....	2
1.5	Implementation Strategy	2
1.5.1	Key Dates	2
1.5.2	Who needs to propose	2
1.5.3	Solicitation Instruments	2
1.5.4	Proposal Format	3
1.5.5	Award Types.....	3
1.5.6	Number of Awards.....	3
1.5.7	Grant and Contract Period of Performance.....	3
1.5.8	Funding Increments.....	3
1.5.9	Research Topics	4
1.5.10	Evaluation Criteria	4
1.5.11	Criteria Weighting.....	5
1.5.12	Proposal Scoring	5
2.0	AUTHORITY	5
3.0	ROLES AND RESPONSIBILITIES	5
3.1	Office of Safety and Mission Assurance (OSMA) (Code Q)	5
3.2	OSMA Software Assurance Manager.....	6
3.3	Chief Financial Office (Code B)	6
3.4	Source Evaluation Board (SEB)	6
3.5	Goddard Space Flight Center (GSFC)	6
3.6	NASA IV&V Facility	6
3.7	Software Working Group (SWG)	7
3.8	NASA Centers.....	7
3.9	Universities and Industry.....	7
3.10	Principal Investigators (NASA, University and Industry)	8
4.0	RESOURCE PROJECTIONS	8
5.0	ACRONYMS	10

1.0 INTRODUCTION

1.1 Purpose

As part of the Office of Safety and Mission Assurance (OSMA) Program Operating Plan (POP) for FY 2005, this Level I plan solicits participation of NASA Center personnel in the OSMA Software Assurance Research Program (SARP). Additionally, it describes the program's goals, objectives, and implementation strategy for FY05 – FY07.

1.2 Program Background

Sound software engineering is critical to all NASA strategic enterprises, yet as a discipline, it is still relatively immature and, moreover, it is constantly evolving. In addition, NASA is confronted with increasing levels of system sophistication and complexity. In order to reliably control and safely operate these systems, a greater dependency is being placed on software. Software Assurance is NASA's software risk mitigation strategy. No matter what organization may perform each of the many tasks of software assurance -- safety, quality, reliability, maintainability, process analyses, product analyses, independent verification and validation, etc. -- they all must be taken into account, scoped, tailored, and balanced for each project. This program was originally put in place to address NASA's continual need to be current in the assurance techniques and methodologies to best determine and provide appropriate software risk mitigation. The program is to respond to both practitioners identified needs and to look ahead to prepare for new ways to understand and prevent hazards and provide greater quality at a reasonable cost. Recent incidents have shown that software reliability and safety are as critical to mission success as hardware safety and reliability. Consistent, proven methods for managing, developing, testing, analyzing, and certifying software need to be continually explored and developed. As the techniques and methods for developing, testing, implementing, and operating software are constantly changing, there needs to be an on going research program focused on how best to assure the quality, safety and reliability of that software. The ever growing complexity of NASA's software, both organizationally and technically, means that software failure modes and reliability are more difficult to evaluate. NASA needs to explore the basic understanding of changing software principles and how to assure them, and then develop, test, and implement the tools, methods, and processes needed to uncover, analyze and address software defects at their root cause.

1.3 Program Goal

The goal of the software assurance research program is to provide NASA with the software assurance practices, methods, and tools needed to produce safe and reliable software. This program is designed to address fundamental software assurance problems in the field of software engineering primarily as it relates to software safety, quality, independent verification and validation (IV&V), testability, and reliability. It is intended to develop and transfer to NASA projects, software assurance practices, methods and tools to improve the quality of the software produced by and for NASA, and to assist NASA in becoming a leader in the development of safe and reliable, cost effective software. Thus, by sponsoring forward thinking research as well as addressing current

needs, the OSMA SARP helps assure that sufficient and appropriate software risk mitigation is applied to the software which controls and monitors our systems.

1.4 Program Objectives

The objectives of the OSMA Software Assurance Research Program are to support promising new software assurance research that facilitates NASA missions and identify, develop, adopt, and integrate software assurance "best practices" and research results into NASA programs to reduce software costs; improve delivery time; and, increase software safety and quality.

1.5 Implementation Strategy

To meet the goal and objectives, the OSMA sponsors the SARP through the NASA Independent Verification and Validation (IV&V) Facility in Fairmont WV. The IV&V Facility assists OSMA in the research selection as well as the technical and management oversight of the awarded research initiatives.

1.5.1 Key Dates

The OSMA SARP operates on an approximate annual cycle. Nominally, this plan is completed in January; proposals are solicited in March, received in June, selected in August, awarded in January and managed to completion.

Date	Action
30-January-2004	Issue FY05-07 Level I Technical Program Plan (proposal solicitation)
30-April-2004	Center Software Initiative Proposals (CSIPs) due
2-July-2004	Software Working Group proposal evaluations complete
20-22-July-2004	Software Assurance Symposium
23-July-2004	Source Evaluation Board recommends new initiatives for award
January-2005	Award new initiatives. Incrementally fund continuing initiatives.

1.5.2 Who needs to propose

Only proposers of new research initiatives need to submit a proposal. Program participants that have an existing OSMA SARP funded research contract or grant whose period of performance extends into FY05 or later need not submit a proposal.

1.5.3 Solicitation Instruments

The OSMA SARP uses this Level I Program Plan to solicit participation by NASA Center personnel. To solicit proposals from universities and industrial organizations, the OSMA SARP uses an annual NASA Research Announcement (NRA) for Software Assurance Research. (The SARP will not issue an NRA for FY05 because a large number of FY03 and FY04 initiatives will be continued into FY05. The amount of

continuing work limits funding for new projects to the point that the FY05 solicitation will be open to NASA Centers only.)

1.5.4 Proposal Format

A proposal template can be downloaded from the OSMA SARP web page <http://www.ivv.nasa.gov/business/research/SARP/index.shtml>.

1.5.5 Award Types

Typically, initiatives are awarded as grants, contracts, or internal fund transfers. A cooperative agreement or other agreement may also be used to fund an effort in response to this plan or the NRA. In those cases where a contract vehicle is already in place or the work is to be done by civil servants, Code Q transfers funds directly to the IV&V Facility or appropriate NASA Center via a Form 506.

1.5.6 Number of Awards

The program anticipates supporting approximately 20 initiatives in FY05. These 20 initiatives will be comprised of new initiatives and continuing initiatives. OSMA SARP management will evaluate the current initiative performance during the year to determine subsequent year funding. The number of FY05 awards will depend on the budget available after funding the continued initiatives from previous years. If all on-going multi-year initiatives that continue into FY05 are funded at their FY04 proposed cost, sufficient funds will be available to award approximately 4 new FY05 initiatives. Section 4.0 RESOURCE PROJECTIONS, FY05-07 Liabilities, New Initiatives and Total Budget Projections (thousands of dollars), depicts the planned FY05-07 budget.

1.5.7 Grant and Contract Period of Performance

Grants and contracts can be for single or multiple years. Typical periods of performance range from one year to three years. Multiple year contracts will have a base year with annual options.

Each year, the OSMA SARP will decide whether to continue funding multi-year projects/initiatives. The decision whether to continue will be based on initiative performance including progress on deliverables and transfer of results to NASA software projects.

1.5.8 Funding Increments

For NASA Centers, Headquarters transfers funds directly to the centers through normal methods. All funds are designated UPN 104-07.

For each grant or contract, NASA will normally process only one procurement request each year. When multi-year projects are supported, researchers should plan to carry over 15-25% of their annual funding through the first quarter of the next fiscal year so as to support work done in the October through December time frame.

Once NASA awards the research initiative grants or contracts, the OSMA SARP management will evaluate the initiative performance during the year to determine subsequent year funding.

1.5.9 Research Topics

The OSMA SARP is seeking research in selected topic areas. The topic areas can be found at the OSMA SARP web page:

<http://www.ivv.nasa.gov/business/research/SARP/index.shtml>. Proposals outside these topic areas will also be accepted provided that the results of the proposed work will contribute to accomplishing the program goal and objectives.

1.5.10 Evaluation Criteria

Consistent with the above goal, objectives and strategy, research initiatives will be selected and funded based on the following criteria:

1. Relevance to software safety and mission assurance
How significant will be the contribution of the research results to the fielding of safe and reliable software to support NASA Missions? Does it address any recognized areas of concern or need for NASA software engineering, management, safety, or assurance.
2. Clarity of objectives
How well did the proposer define the objectives of the proposed work? How specific and measurable are the objectives? Will an observer be able to clearly determine that an objective has been satisfied?
3. Feasibility of methods and procedures
What's the likelihood that the proposer will be able to implement the proposed research methods and procedures within resource constraints? How likely are the proposed methods and procedures to result in accomplishing the proposed objectives?
4. Potential for technology transfer to NASA software projects
How likely are NASA software projects to use the results of the proposed research? How likely are the proposed results to be applicable to situations beyond the scope of the original research? How well does the proposed research address issues that would likely be encountered in other programs? How well does the proposer identify other NASA program(s) or strategic enterprise(s) that could apply the proposed research results? How well does the proposer show how other NASA program(s) or strategic enterprise(s) would apply the knowledge gained from the research?
5. Clarity of success criteria and progress metrics
How well does the proposer define the conditions for success? How much interpretation will be required to know if the initiative was a success? How well does the proposer define how they will measure, track and report progress toward achieving success? Are there sufficient clear interim objectives to determine progress and the extent to which the overall objectives are being achieved?
6. Value of the proposed research for the estimated cost
How much are the research results worth compared with the estimated cost?

7. Uniqueness of proposed research

To what degree is the proposed research distinctive from other current and past, valid research? Do the investigator(s) demonstrate knowledge of other research relating to the proposed research? Do they clearly identify the differences between their research and similar or related research?

8. Qualifications of the research team to do the proposed research

How qualified are the members of the proposed research team to carry out the proposed research? How relevant are their capabilities, experience, and facilities relevant to the proposed area of research? How well qualified is the Principal Investigator or team leader?

9. Past performance of the research team (where available)

How has the research team performed on past research projects? How did their actual deliverables compare with their planned deliverables? How many periodic reviews did they plan and how many did they actually conduct?

10. Overall quality of proposed initiative

Considering all of the above factors, how good is the proposal?

1.5.11 Criteria Weighting

Relevance to software safety and mission assurance (criterion 1), potential for technology transfer to NASA software projects (criterion 4), and the overall quality of the proposed initiative (criterion 10) will be weighted twice as much as the other criteria.

1.5.12 Proposal Scoring

Proposals will be evaluated using a five-point scale for each criterion. Concerning criterion 9, past performance of the research team, if the proposed research team has not performed previous OSMA SARP research projects, this criterion will receive a score of 3 points.

2.0 AUTHORITY

Michael Stamatelatos, the Director, Safety and Assurance Requirements Division, oversees the SARP. He establishes research objectives, approves the results of the Source Evaluation Board (SEB), and delegates the administrative management of the SARP to the IV&V Facility.

3.0 ROLES AND RESPONSIBILITIES

3.1 Office of Safety and Mission Assurance (OSMA) (Code Q)

Code Q is the immediate customer for this research. Code Q provides the funding and delegates the implementation responsibility for the program to the NASA IV&V Facility. Code Q provides the Level I plan to Code B. In addition to funding the software assurance research, Code Q funds the annual Software Assurance Symposium that showcases the research results.

The Director, Safety and Assurance Requirements Division, is the Source Selection Official (SSO) and as such has source selection authority for the NRA. The SSO commissions a Source Evaluation Board to evaluate proposals and provide recommendations for selection.

3.2 OSMA Software Assurance Manager

The OSMA Software Assurance Manager (Martha Wetherholt, Martha.S.Wetherholt@nasa.gov) in Headquarters Code Q, participates in the selection of research, addresses Headquarters level budget issues, and periodically reviews the program status. The OSMA Software Assurance Manager works with the IV&V Facility to develop the Level I plan and NRA, works with the IV&V Facility to develop the Level II plan, conducts periodic reviews with the IV&V Research Lead, and participates in the coordination and arrangement of the Software Assurance Symposium.

3.3 Chief Financial Office (Code B)

Code B distributes the Level I plan to the NASA Centers as part of the Program Operating Plan (POP) call to alert the Centers to the opportunity to submit proposals.

3.4 Source Evaluation Board (SEB)

The Source Evaluation Board evaluates proposals in response to both the POP call and the NRA and provides recommendations to the SSO. The SEB also evaluates the performance of on-going research initiatives and provides continuation and funding recommendations for them to the Director, Safety and Assurance Requirements Division.

The SEB will include at a minimum three individuals: the OSMA Software Assurance Manager, the SWG Chair and the IV&V Facility Research Lead.

3.5 Goddard Space Flight Center (GSFC)

GSFC is the administrative office for the NASA Research Announcement that is used to solicit proposals from universities and industrial organizations. GSFC procurement personnel serve as contracting officers for awards to universities and industrial organizations.

3.6 NASA IV&V Facility

The IV&V Facility manages the OSMA Software Assurance Research Program for OSMA. In cooperation with the OSMA Software Assurance Manager, the IV&V Facility drafts the Level I Technical Program Plan and, if sufficient budget is available, the NRA. The Level I plan (this document) serves as a call for NASA Center proposals. The NRA serves as a call for proposals from universities and industry. GSFC procurement issues the NRA. An NRA will not be issued for FY05 because the budget is insufficient to support it. (See Paragraph 1.5.3.)

Proposals are submitted to the OSMA SARP Web-based data repository that the IV&V Facility maintains. Upon receiving proposals, the IV&V Facility notifies the SSO and the OSMA Software Assurance Manager.

The SSO instructs the SEB to evaluate the proposals.

The SEB may contact members of the NASA Software Working Group (SWG) to assist in proposal evaluation. The IV&V Facility provides administrative and technical support to the SEB. The SEB evaluates the proposals and provides recommendations to the SSO.

The SSO selects proposals for award. For successful university or industry proposals, GSFC procurement establishes appropriate instruments, such as grants or contracts.

The IV&V Facility, in coordination with the OSMA Software Assurance Manager, prepares a Level II Operating Plan incorporating the recommendations from the SEB. The Safety and Assurance Requirements Division Director's signature on the completed Level II Plan constitutes selection of proposals. The Level II Plan contains a list of the proposals selected for award. The Level II Plan also contains center-level funding distribution. (Note that the Level I plan can cover several fiscal years while the Level II Plan, which contains adjusted center-level funding, covers only the upcoming fiscal year.)

Once the period of performance has begun, the IV&V Facility conducts quarterly program management reviews with each principal researcher. The IV&V Facility will present an informal monthly report to the OSMA Software Assurance Manager concerning the state of the research.

The IV&V Facility maintains a Web-based repository of initiative research results that have been approved for public dissemination by NASA. The IV&V Facility conducts, for OSMA, an annual symposium, usually in West Virginia, to provide a forum for the initiative principal investigators to present their research results to OSMA and to their peers. Attendance of all SARP principal investigators is required.

3.7 Software Working Group (SWG)

The SEB may request the SWG to evaluate proposals. Software Working Group members or their designees evaluate the proposals using templates and a process that the IV&V Facility establishes in the Web-based data repository. The IV&V Facility compiles the evaluation results and provides them to the SEB.

3.8 NASA Centers

All NASA Centers are invited to participate in this program. NASA individuals and organizations that wish to propose should draft a proposal. The proposal provides the information required by HOWI 7410-Q030, OSMA Budget Formulation, Appendix B. The proposal format can be downloaded from the OSMA SARP web page at <http://www.ivv.nasa.gov/business/research/SARP/index.shtml>.

Contact the IV&V Facility Research Lead for more information.

3.9 Universities and Industry

Universities and industrial organizations already working in conjunction with a NASA Center or directly with the IV&V Facility can propose as a center initiative through their sponsoring NASA organization providing that the proposed research is within scope of their existing contracts. For universities and industrial organizations not associated with

NASA, the GSFC procurement office will post the NRA for Software Assurance Research in the Commerce Business Daily (CBD) and the NASA Acquisition Internet Service (NAIS). The NRA can also be downloaded from the OSMA SARP web page at <http://www.ivv.nasa.gov/business/research/SARP/index.shtml>. (An NRA will not be issued for FY05 because the budget is insufficient to support it. See Paragraph 1.5.3.)

3.10 Principal Investigators (NASA, University and Industry)

Principal Investigators are responsible for scheduling and executing quarterly reviews with the IV&V Facility. Researchers will be required to give a quarterly status report on their initiative(s), and will be required to present their findings at an annual symposium in West Virginia. The FY04 symposium is July 22-24, 2004 at the Lakeview Resort and Conference Center in Morgantown, WV.

4.0 RESOURCE PROJECTIONS

The projected annual resources for the OSMA SARP are 4.6 million dollars. Table 4-1 shows the FY05-07 budget. Except for JPL, each Center's budget is for procurements only. The JPL budget includes full cost accounting.

The budget is planned to be allocated to on-going multi-year initiatives (liabilities) and new initiatives. FY05 liabilities are definite. They are required to fund current multi-year grants and contracts. \$741 K is programmed to support FY05 new initiatives. The SEB will determine the distribution for these funds when it meets in July 2004. The Operating Plan to be published in August 2004 will document the SEB's recommended funding distribution. The out-year liabilities are also based on existing multi-year grants and contracts but can change. The distribution projections among the Centers for FY06-07 new initiatives and overall budget are extrapolations of past distributions.

Table 4-1: FY05-07 Liabilities, New Initiatives and Total Budget Projections (thousands of dollars)

	FY05 Liabilities	FY06 Liabilities	FY07 Liabilities	FY05 New Initiatives	FY06 New Initiatives (projected)	FY07 New Initiatives (projected)	FY05 Budget	FY06 Budget (projected)	FY07 Budget (projected)
Center Initiatives	2,938	1,737	0	741	1,942	3,679	3,679	3,679	3,679
Ames Research Center	751	560	0	TBD	186	552	751	746	552
Glenn Research Center	0	0	0	TBD	276	552	0	276	552
Goddard Space Flight Center	225	0	0	TBD	417	552	225	417	552
Jet Propulsion Laboratory	390	345	0	TBD	267	736	390	612	736
Johnson Space Center	119	124	0	TBD	43	184	119	167	184
Marshall Space Flight Center	0	0	0	TBD	92	184	0	92	184
Code Q	672	327	0	TBD	278	368	672	605	368
IV&V Facility	780	382	0	TBD	382	552	780	764	552
August 2004 Research Awards (parked at Code Q)				741			741		
University Initiatives	550	550	550				550	550	550
WVU/IV&V (Task ID # 400)	550	550	550				550	550	550
Contracted Technical Support for OSMA SARP	365	365	365				365	365	365
ASSET contract (Task ID # 402)	365	365	365						
Software Productivity Consortium	6	6	6				6	6	6
Total:	3,859	2,658	921	741	1,942	3,679	4,600	4,600	4,600

5.0 ACRONYMS

Acronym	Definition
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CBD	Commerce Business Daily
CI	Center initiative
CSIP	Center Software Initiative Proposal
FY	Fiscal Year
GSFC	Goddard Space Flight Center
HQ	Headquarters
IV&V	Independent Verification and Validation
NAIS	NASA Acquisition Internet Service
NASA	National Aeronautics and Space Administration
NRA	NASA Research Announcement
OSMA	Office of Safety and Mission Assurance
POP	Program Operating Plan
SARP	Software Assurance Research Program
SEB	Source Evaluation Board
SMA	Safety and Mission Assurance
SSO	Source Selection Official
SWG	Software Working Group
UI	University Initiative
UPN	Unique Project Number